



Executive Summary

A Proposal to the
Metropolitan Transit Authority
of Harris County

Fixed Guideway Transit System





ALTERNATIVE PROPOSAL

Over the last six years, the T&I Team has met and had discussions with various community and business leaders regarding METRO's proposed fixed guideway transit system. Based on these discussions, we are proposing that METRO seriously consider modifications to the baseline configuration which we believe will enhance the cost effectiveness and attractiveness of the Phase 2 Year 2000 Plan.

We will continue to work with METRO and these community groups to finalize the system in the months to come. Our alternative proposal includes the following elements:

- **Shifting the Initial Line from Richmond Avenue** to follow the northern frontage road of US 59, thereby reducing the local impact to residential neighborhoods adjacent to Richmond Avenue.

- **Working with the downtown community**, particularly in the Historic District, to develop a design solution which is sensitive to the unique character of the District.

- **Rerouting the Texas Medical Center (TMC) Line** to the eastern perimeter of the complex.

- **Introducing an automated UM Series Monorail people mover system** in the TMC with connections to the mainline monorail at both the TMC Station and the Brown Lot Station, for distribution within the Texas Medical Center. This system saves two buildings within the complex, replaces the Holcombe Station with a series of people mover stations serving the entire complex, and provides much better service.

- **Introducing a circulator system in the Uptown Area**, either a UM Series Monorail or electrically-propelled buses or light rail vehicles with extensive traffic and urban design improvements, to better serve the retail and commercial complexes within the Uptown area, connecting with frequent service to the Post Oak Station of the Initial Line.

- **Adopting future extensions of the mainline monorail and light rail system** to include the Northwest Transit Center, the Houston Intercontinental Airport, Hobby Airport, and continuing expansion of the successful transitway program along US 59, I-10, etc.

- **Adopting an incentive program and private financing assistance in an effort to accelerate completion of the system** by up to two years from METRO's schedule.

These elements have been carefully selected to ensure that METRO's proposed schedule will not be jeopardized, and to ensure consistency with the ongoing federal funding process.





Can The Monorail System be Funded?

Yes. TGI's proposed system can be implemented within METRO's budget and METRO's funding plan is achievable. The Phase 2 capital budget for METRO's Fixed Guideway System is \$1.09 billion (in constant 1988 dollars). Approximately \$570 million is expected to be funded from federal grants, \$145 million of which already is committed. The remainder would come from local sales tax revenues which are already in hand (\$390 million) and private sector contributions (\$130 million).



How Much will the System Cost?

TGI estimates that the total system, defined as:

- 13.6 mile monorail initial line from downtown to West Belt station
- 5.3 mile monorail line to the TMC/Astrodonne
- 4.5 mile Southeast/Universities light rail line
- local circulation systems at Texas Medical Center and Uptown

can be provided within METRO's \$1.09 billion 1988 budget. The TGI Team has arrived at this by taking our firm fixed price proposal for the system-wide elements and adding fixed facility construction and agency cost estimates for METRO. The fixed facility costs are based on the actual cost of monorail and light rail system elements applied directly to Houston.

Can the Private Sector Funding Participation be Achieved?

Yes. At least \$130 million, and very likely a lot more, can be generated from the private sector. TGI, Lehman Brothers and JMB have closely analyzed a full range of options from which METRO can choose in order to generate substantial private sector contributions. Each option has a track record of proven viability and all of them are applicable to the Houston situation.

The options range from up-front interim construction financing programs, which would generate early contributions, to medium and long term real estate development related opportunities, which would generate ongoing contributions over the life of the project. The options have significant value individually and substantial value when considered collectively.

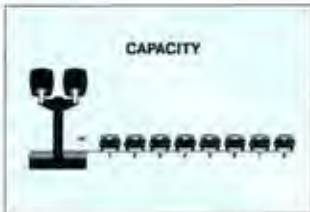
The TGI Team is proposing a comprehensive program to assist METRO in securing the private sector participation.



Why is this a Good Investment for Houston?

Because it will deliver the lowest overall cost per passenger of all alternatives which are capable of really making a difference in meeting Houston's transportation challenge.

All world-class cities like Houston place severe demands on their transportation systems, especially when they are experiencing economic growth and development. Leaders of almost all of those cities have concluded that there is a direct connection between transportation, economic health and environmental quality — that, in direct terms, it is far too risky to place total reliance for urban mobility on only one form of transportation, be it the private automobile or public transportation. Therefore, almost all of the truly great cities have solved to develop a balanced approach, where the private automobile and public transportation provide mutually supportive mobility alternatives.



Houston's transportation system is still almost totally dependent on the private automobile, making Houstonians particularly vulnerable to the undesirable effects of traffic congestion — economic "booms", massive gasoline price increases and gasoline shortages, and natural disasters like floods and hurricanes.

The cost effectiveness of proposed investments in transportation, whether for new roads and bridges or for a monorail system, all should be measured by the same yardstick: the total cost of building, operating, maintaining, rehabilitating, and when necessary, replacing the transportation system. The TGI Team is convinced that when this yardstick is applied fairly and equally to proposed new highways and bus systems, and to this proposal, the monorail system represents a lower cost

solution relative to other major transportation investments. Other such studies in similar western cities have shown that the overall life-cycle cost per trip of a well-conceived public transportation system is lower than the true cost for a bus-only or private auto-only highway system, and a properly conducted analysis in Houston will inevitably yield the same result.

This does not mean that Houston should invest all of its mobility dollars in the monorail. It simply suggests that in addition to repairing and expanding the highway system to meet the requirements of renewed growth and development, a monorail system should be built to provide a low cost, attractive mobility alternative.

The monorail is a long term investment with the capacity to accommodate both sustained and sudden demand increases, in a manner analogous to new water treatment and distribution facilities. METRO projects that the Initial Line alone will carry over 67,000 trips per day, and the TGI monorail system has the capacity to carry well over 200,000 trips per day.

Will the Monorail System Save Money Versus a High Quality Bus-Only System?

Yes...the Monorail will cost less to build. This is true because we would need to build very costly and obtrusive aerial structures for the buses in order to achieve equal time, capacity, and service frequency levels comparable to the monorail.

Is There a Lower Cost Bus-Only Solution?

Sure there is, but it would require far more buses to run on city streets, and would not provide the speed, capacity, noise, service quality, image, and operating cost advantages and efficiencies of the monorail.

How Much Will it Cost to Ride the Monorail?

We expect fares set by METRO to be comparable to those of equivalent bus service.

What Will be the Impact of the Monorail System upon METRO's Operating Deficit?

Our estimates show the monorail service on the Initial Line to operate at a much lower deficit than



WHERE ARE INTERNAL CIRCULATION SYSTEMS NEEDED?

The best candidates are the Texas Medical Center, Uptown, Downtown, Greenway Plaza, and the University of Houston. These centers of activity are of such size and complexity that they warrant a fair and comfortable means to move mainline monorail passengers to destinations located beyond a comfortable walking distance from the station. Internal circulation systems will function as an integral and important element of the overall transportation network, serving not only mainline monorail passengers, but also dispatchers, vanpools, and bus passengers.

The TGI Team is proposing a smaller scale automated monorail people mover system to interface with two of the mainline MVI Monorail stations of the Texas Medical Center/Astronaut line. TGI offers an LM Series Monorail for this application because it is ideally suited to carry passengers through the more tightly confined areas of the Texas Medical Center, with frequent station stops at a much lower cost than any other elevated guideway technology.

The fully automated LM Series Monorail is being implemented by TGI in several other similar applications worldwide, and is also a strong candidate for service in other areas of Harris County such as Uptown Houston and the University of Houston.

The Uptown area, with its linear growth pattern centered along Post Oak Boulevard, could benefit greatly from circulation service linking the mainline monorail station on Post Oak to the many retail and office complexes located beyond a comfortable walking distance. Discussions with leaders of the Uptown area have led us to propose consideration of at least three options to serve this purpose: the initial deployment of circulator buses; implementation of a LM Series Monorail or light rail circulation and distribution system; or an extension of the mainline monorail system through the area in a north/south orientation (and eventually to the Northwest Transit Center). These circulation alternatives for Uptown, and the funding and implementation approach to be used to make the selected option a reality, will be investigated in cooperation with Uptown's community leaders.

In Downtown Houston, all of these options also will be investigated with the Downtown business community. It should be possible to accelerate the completion of these circulation and distribution systems to coincide with the opening of the initial line of the monorail.

PEOPLE MOVER LINKAGES





SEL Division of Alcatel Canada, Inc., the world leader in the provision of fully automatic train control systems, will design for the Houston Monorail. SEL is the only company able to meet all of METRO's sophisticated technical train control requirements with a system proven on the world's longest driverless rapid transit line.



Johnson Controls, a world leader in the provision of environmental control systems, facility management systems, and facility operations, will play a major role in the operation and maintenance of the Monorail System.



The Houston office of the Transportation Division of **Lehman Brothers** (formerly known as Shearson Lehman Hutton), an industry leader in innovative transit financing, will be responsible for the private-sector funding participation element.



JMB Urban Development Company, the largest real estate development and property management firm in the United States, will be responsible for the joint development and value capture plan, working together with Lehman Brothers.



Fulbright and Jaworski, one of the largest and most respected law firms in Houston, will serve as the TGI Team's local legal counsel.

The TGI Team's Responsibilities

The TGI Team's proposal responds to METRO's request to provide the system-wide elements of the fixed guideway project under a single contract. Under METRO's proposed division of responsibilities, METRO will contract directly with local firms for the construction of the fixed facilities (guideway columns and foundations, stations, and the maintenance facility), and our team will manage the construction of those facilities.

While we have prepared a proposal to supply METRO with only the requested system-wide elements, the TGI team also is prepared to design, build, operate, maintain, and finance the entire monorail system on a private contract basis, should METRO desire.

Regardless of the procurement approach selected by METRO, the TGI Team believes that the selection of the routes and technologies for the fixed guideway system should be a public sector responsibility, with direction from a publicly appointed Board of Directors answerable to elected public officials.

Disadvantaged Business Enterprise (DBE) Participation

The TGI Team is committed to achieve the substantial participation of DBE firms in the project. We already have initiated what will be a continuing effort to identify and contract with individual firms who either are already METRO-certified or are capable of being certified.

We believe a project of this magnitude and impact creates opportunities to involve the minority and women-owned business community in the broadest possible way. Therefore, we intend to add to our Team a local minority enterprise with responsibility for facilitating the participation of DBE firms in the design, construction and operation of this project. Our proposal identifies a large number of certified firms which are ready to perform certain aspects of the work and have been pre-qualified by the Team for participation in the project. The bottom line is that this project will create thousands of jobs in the Houston area.

TGI's parent corporation, Bombardier, and Kiewit both have compiled outstanding records in supporting minority-owned business enterprises in the North American transit industry. They strongly support the TGI Team's commitment to meeting METRO's goals.





THE TGI TEAM

Just as important as the technology being proposed is the team which will install and operate the transit system. We are proud to have assembled the strongest team in the history of the public transportation industry, with

strong Houston representation. Each company is a recognized leader in its industry with many years of experience in its field.



The Transportation Group, Inc. (TGI) of Orlando, Florida, and Kiewit Construction Group Inc. (Kiewit) of Omaha, Nebraska have formed a joint venture to manage and deliver the Fixed Guideway Transit System for METRO.

TGI, the systems subsidiary of Bombardier Inc., has compiled a proven track record in the delivery of transit systems in the United States. TGI will provide the transit vehicles, automatic train control, communication and fare collection subsystems. Additionally, TGI will manage the private financing aspects of the system and operate and maintain the system should METRO desire.



Kiewit has completed over 50 urban mass transit contracts throughout the United States and Canada and is the nation's largest employer-owned construction company. Kiewit's subsidiary, Gilbert Texas Construction Corp., will be responsible for the design and construction of the monorail guideways and power distribution system and will manage the construction of the fixed facilities.



TGI's parent company, Bombardier Inc., is North America's largest provider of rail guideway vehicles. Based in Montreal, Quebec, with manufacturing facilities in four U.S. states, as well as in seven other countries, Bombardier is involved in the transit, aerospace, and recreational products industries. Bombardier's Mass Transit Division will manufacture the monorail vehicles.

DeLEUW CATHER

DeLeuw, Cather & Company is a major transportation engineering firm in the United States and a subsidiary of The Parsons Corporation, one of the largest engineering and construction companies in the world. A leader in the planning, design, and construction management of public transportation systems for over 71 years, DeLeuw will serve as the team's principal transportation system engineers.

PAE & ENGINEERS

Pate Engineers, Inc. is a Houston-based civil engineering firm with over 20 years of experience. Pate will be responsible for civil engineering.



Ray Bailey Architects, Inc. of Houston have established a reputation for quality urban design and integration throughout the region. Working together with the Zimmer Gunsul Frasca (ZGF) Partnership of Portland, they will be responsible for station design and urban design.

Representative TGI/ Bombardier Installations/ Contracts

Existing:

- Portland, Oregon
- Walt Disney World Resort
- New York City Transit Authority
- Houston Intercontinental Airport
- Paris METRO
- Montreal METRO
- AMTRAK
- Massachusetts Bay Transportation Authority
- Southeastern Pennsylvania Transportation Authority
- New York Metro North
- New Jersey Transit
- Connecticut DOT
- Illinois Great Gulf R/R

Ongoing:

- English Channel Tunnel
- London Docklands
- U.S. Capitol Subway in Washington, D.C.
- Downtown People Mover, Kuala Lumpur, Malaysia
- People Mover, Tampa International Airport





INTERMODAL CONNECTIONS

Intermodal connections are made at stations where passengers will transfer from one mode of transit to another, for example, from the line haul monorail system to a smaller monorail circulator or from a feeder bus to the line haul monorail system.

Can These Intermodal Connections Really Work?

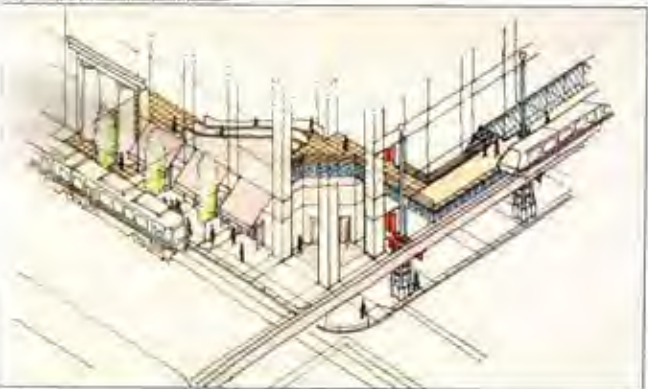
Yes, because they will be so convenient and quick. Mainline monorail stations are the principal locations where intermodal connections are made. To really make public transportation work for Houston, these intermodal stations must function extremely well. Transfers between system elements must be a positive experience.

High frequency service is the key to success. Automatic driverless mainline monorail trains and high frequency circulators will allow Houston to achieve an unprecedented level of service. High quality station design

is also important. Protection from the elements, lighting, safe, open designs, and very short walks between modes will help passengers to use...and enjoy...the system to its full potential.

It is vital that the monorail serve all who can benefit, including those who arrive by carpool, vanpool or bus. The TGI Team commits to work directly with METRO and the Texas State Department of Highways and Public Transportation to establish direct links between the tramway system and the mainline monorail stations. Candidate stations for such a connection on the Initial Line are Hinkoff and Post Oak for interface between the U.S. 59 Tramway and monorail system. This could entail direct ramp connections being implemented jointly by METRO and the Highway Department for station access by buses, carpools and vanpools. Under this approach, station areas also would provide preferential close-in parking dedicated to carpools and vanpools.

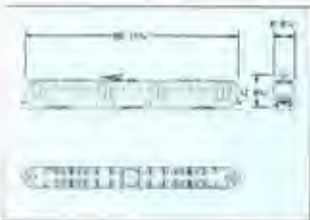
Concept drawings for intermodal connections in downtown





WHAT IS THE PROPER ROLE OF LIGHT RAIL?

Light rail transit can serve some lower demand routes at relatively low cost, and the TGI Team believes that Houston should not try to "force-fit" one mode of transit into every situation. While the MVI Monorail is optimized for Houston's higher speed, higher capacity applications, there are other travel corridors where the passenger volumes and the traffic characteristics of the linked system allow the introduction of cost-efficient, at-grade light rail transit service.



The TGI Team proposes to supply a Light Rail Transit system, based on the highly successful Portland, Oregon "MAX" system, for the Southeast Universities Line. All Bombardier's subsidiaries have produced more than 1,100 Light Rail Vehicles worldwide; this technology system is another facet of the four transit systems available through the TGI Team.



Each light rail vehicle draws electric power from its overhead power system, with the capacity to carry 76 seated and 110 standing passengers at speeds reaching 55 miles per hour over the short 4.5 mile route from downtown Houston to the University of Houston. Intermediate stations provide a link from the monorail IRTM Line to the George R. Brown Convention Center and Texas Southern University.

Houston Light Rail vehicle



Features of the Southeast Universities LRT line include:

- Line capacity which easily meets METRO's initial and future ridership requirements
- Average wait time of 2.5 minutes during peak ridership hours and 7.5 minutes during off-peak hours
- Air-conditioned vehicles designed to keep passengers cool in the Houston climate
- High platform loading to provide full access to mobility impaired passengers
- Ability to expand up to four vehicles for future ridership growth
- Easy connection with future lines
- High quality design comparable to that of the Portland system





Operations and Maintenance



Houston Monorail meeting the most exacting requirements.

The initial line will operate daily from approximately 5:00 am until 1:00 am the following morning. **Passengers will enjoy extremely frequent service throughout the day.** Ultimately, vehicles will be scheduled as frequently as arrive every 80 seconds, a demanding schedule which the monorail system has the ability to meet with an extremely high degree of reliability.

Monorail systems provide significant advantages in reduced maintenance of both vehicles and guideway. The vehicle design incorporates a true changeout philosophy by using modular subsystems, allowing for the rapid replacement of units and the prompt return of vehicles to service. Rubber tire changeout, for instance, requires less than one hour, even though the tires have an expected life of over 100,000 miles, needing replacement less than once per year.

The guideway itself, contacted only by the rubber tires, experiences almost no wear and is virtually maintenance free, a significant advantage over the constant maintenance of rails required of light and heavy rail systems.

The operations and maintenance headquarters will be located adjacent to the present bus maintenance facility at the western terminus of the initial line, near Hansen and Boone. The elevated guideway throughout the maintenance yard enables use of the ground level for parking and other activities.



Monorail vehicle design.

HOUSTON MONORAIL



The fare collection system is designed on the proof-of-payment principle, thus eliminating the need for barriers and computers where passengers access station platforms. Proven in many recent U.S. and Canadian rapid transit installations, "self-service" fare collection permits ticket vending equipment to be conveniently located near the entrance to each station while providing the maximum flexibility in passenger method. This eliminates the need for bulky and unsightly barriers and turnstiles, and for separate "paid" zone restrictions.

With average waiting times for trains ranging from only about one to one and a half minutes during peak periods, to no greater than four minutes off-peak, passenger stations are unnecessary. However, comfort and safety are of paramount importance, and each station will have bright lighting, seats, direct phone links to security forces, and public telephones. In addition to the open design, each station will be under the constant scrutiny of a closed circuit video security system. Transit Police and other emergency response personnel can be summoned immediately to supplement riding security personnel.

From Houston, Mayfield



From Houston, Mayfield



As part of the TGI Team, the nationally recognized architectural and urban design firm responsible for the award-winning Portland downtown redevelopment associated with that city's new "MAX" light rail transit system, teamed with locally resident, mission-based architect and urban designers, bringing the highest level of design capability to create the stations for the Houston Monorail.

From Houston, Mayfield

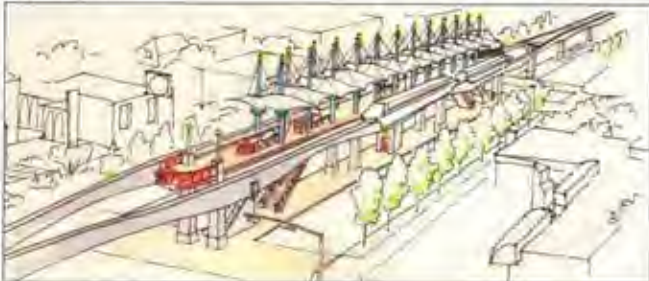




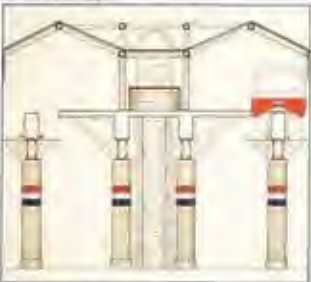
Stations

Consistent with the lightness of the guideway structure, Houston's monorail stations will be designed to convey an open and pleasant atmosphere. Benefiting from the uniquely narrow profile of the guideway (and the high frequency service which permits short trains), the stations are far less expensive to construct and fit much more readily into the urban environment than the stations needed for conventional rail.

Art by Kenneth Anderson Associates

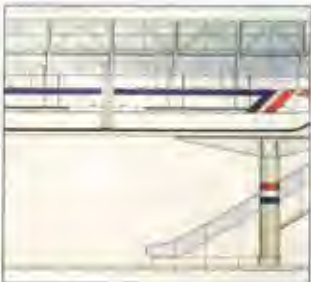


Architectural design by



The stations will be a blend of function and artistry, designed to provide comfortable, safe access to the monorail system with protection from adverse weather. Each station will be designed by Houston-area architect(s), with the input of local community leaders, to incorporate the theme of the specific neighborhood it serves.

The interior of the stations will continue the philosophy of easy accessibility for all patrons. Elevators and escalators will assure freedom of access for the mobility impaired.





Automatic Train Operation

Fully automatic, driverless control of the system will be provided by the world's leading train control technology SELTRAC, thoroughly proven in Vancouver, the world's longest driverless rail transit system.

Through an integrated system of sensors located along the guideway at all switches and onboard the vehicles, the actual position of every vehicle and the status of all subsystems is constantly monitored, permitting actual headways as low as 40 seconds between stations in Vancouver.

This system and metro's sensors designed to indicate the presence of a person or object which may have fallen onto the guideway from the station platform, and will prevent vehicles from entering the station under such conditions. All of this advanced yet proven technology helps the TQJ monorail provide important advantages to the passenger — including very short wait times and highly reliable service.

The nerve center of this sophisticated system lies at the Central Control Center, a secure room staffed around the clock, where computers control the Automatic Train Control System and security personnel monitor each station via closed circuit television monitors.

(Continued on p. 10)



Central Control Center

Emergency Evacuation

In compliance with design guidelines for elevated rapid transit systems, METRO has specified that an emergency walkway be provided throughout.

The walkway for the monorail will be securely located between the two guideways on dual line sections. Protective sidings will allow for the safe transfer of passengers to the nearest station or to an emergency entrance, just as with conventional rail systems.





passenger to operate due to the extremely lightweight car design, the AC motors will regenerate power during the braking phase. This surplus power can be used by other accelerating vehicles in the network, thereby reducing the draw from the Houston Lighting and Power System and providing further energy savings. This principle of energy regeneration actually will make the overall energy efficiency improve with increasing passenger demand.

Automatic operation of TGI's monorail system by the most flexible and efficient computerized train control system in the world provides further efficiencies. Smaller trains can operate much more frequently without incurring a proportional labor penalty and without needing the long and unsightly trains and stations required by most conventional rail systems.

Monorails really are one of the safest systems in the world! The highly successful Mark VI and VI monorail vehicles, which have literally billions of passenger miles of service in the Walt Disney World Resort in Orlando, have the remarkable safety track record of never having suffered a passenger fatality or serious injury while carrying up to 200,000 passengers per day.

Space-age composite components used in the vehicle provide not only significant advantages of light weight realized by monorail, but also offer superior fire, shock and toxicity resistance for passenger safety.

In addition to safety and efficiency, the monorail vehicle is designed with passenger comfort in mind. The standard configuration of interior of the vehicles, occupies more than half of their passenger capacity to seats, incorporate air-conditioning, bright lighting, high quality public address systems and emergency communication links to central security personnel.

We are convinced that the M VI monorail vehicle is the most technologically advanced transit vehicle in the world.

Guideway

The M VI is a true straddle-type monorail. The weight-saving design of the vehicle and its unique wrap-around suspension system allows the supporting guideway to be dramatically smaller than any other transit system guideway of comparable passenger capacity, worldwide. Quiet, reliable, nitrogen-filled rubber tires for both drive and guidance permit the guideway to be built of arched, steel, rib-reinforced concrete, requiring only a 26 inch wide curving surface.



Monorail for a great Houston

The guideway has a proven, economical design which gives the M VI monorail a great advantage in both initial construction and ongoing maintenance costs over other forms of guideway transit system. The guideway is constructed in typical 100 and 110 foot span lengths, not only reducing the "footprint" of the supporting structure, but also by at least 25 percent the number of supporting columns and foundations required throughout the system. This efficient guideway gives monorail a significant cost advantage over other transit guideway systems.

Construction of the monorail guideway is a simple and relatively fast process, minimizing the impacts on the neighborhoods through which it travels.

- by reducing the width of the right-of-way needed for the support structures;
- by reducing traffic disruption during construction with its ability to precast beams and columns at a remote casting yard to be trucked to the construction site and lifted and secured rapidly in place;
- by taking advantage of construction techniques for the foundations which reduce the need to relocate costly underground utilities.

Simply put, the monorail guideway requires far less concrete and steel than conventional elevated rail structures due to its smaller cross-section.





HOUSTON'S TRANSPORTATION CHALLENGE

Does Houston Really Have a Transportation Problem?

Yes. Houston is facing a major transportation challenge once again.

As the economy of Houston rebounds, the operative word is *more*. Renewed growth and development will mean *more* business, *more* employment, *more* people, *more* activity, *more* retail sales, *more* wholesale deliveries, *more* trucks, *more* vans, *more* cars, *more* than ever before... *more* cars/trucks in the air, *more* noise, *more* waiting, *more* delays, *more* frustration, *more* movement cost for transportation... and a lower quality of life for all Houstonians.

- Over 40,000 newly registered automobiles are being added to Houston's roads every year.
- Houston has fewer miles of interstate freeways per capita than any of the nation's 25 largest metropolitan areas.
- Buses already carry 24% more passengers each day than they did only 11 years ago but they too must compete for available road space.





Are these predictions scare tactics, or could they be real? Well, remember the stop and go traffic of '73 and '83...and if the extrapolation to '93 is scary think about 2003! Even if more roads alone can solve the problem (and they can't) — just ask Los Angeles! — how many 24 lane roads and spaghetti junctions can Houston afford? Even if the dollar cost can be covered there is simply not enough space available to solve the problem by building highways alone.

The problem is certainly widening because of world tensions. Rapidly escalating oil prices are helping to stimulate the Houston economy (and increase driving costs), but we believe that, even without the current speculation about oil supply the recovery and growth were inevitable. Houston's natural geographic, commercial and other advantages...and the continuing hard work of many...ensure long term growth...and the consequent inevitability of a real challenge in meeting the City's movement needs without all the "indies" mentioned above.

All of the above factors mandate that a mobility alternative be implemented in Houston. The challenge is to implement a solution which serves the needs of the City's residents and is affordable, non-polluting and not dependent on foreign oil.

Until now, no one has come forward with a public transportation proposal in which Houstonians can have confidence.

The unique nature of Houston requires a unique transportation solution...an alternative to the costly heavy rail solutions of the past, which were devised to serve more densely developed cities.

Some academics have suggested that conventional rail transit is a poor investment for Houston and, to a certain extent, we agree: conventional rail solutions which were appropriate for the older eastern cities are inappropriate for Houston because of the region's unique development form. Large commercial and employment concentrations located not only in the Downtown area but also in the Uptown (Galleria/Post Oak) and Texas Medical Center — with moderate residential density — demand a lower cost, more modern and more economical solution...like the monorail...and inadequate coverage by rail would be far too costly and disruptive.

Can either monorails or highways alone solve the problem?

No. Simplistic solutions which depend solely on one mode of travel are doomed to failure, and at best, are too inefficient and costly to warrant the support of the taxpayers. A modern and efficient public transportation system, based on a modern monorail working together with the bus and highway systems, can begin to have a real impact on the undesirable impacts of congestion.

In responding to METRO's Request for Proposal to provide a fixed guideway public transportation system, the TGI Team proposed a monorail system which will not only provide better service and attract people to public transportation but also relieve some of the pressure on the highways.

The New Urban Form

Houston has experienced dramatic changes. While the post-war decades produced rapid suburbanization and the '70's brought the re-intensification of downtown, the '80's produced a uniquely North American phenomenon: the "urbanization of the suburbs" — a concentration of intense mixed use development in new suburban centers.

These suburban activity centers present new and perplexing challenges to public transit systems because they are designed almost entirely around the private automobile. These complexes exhibit few, if any of the characteristics which contribute to the success of traditional mass transit systems.

The TGI Team believes that careful integration of transportation modes is required to meet this challenge.





A VISIONARY SOLUTION

Why Not Just Build a Conventional Rail System?

Because for a 21st-Century City like Houston no single form of high cost transportation can efficiently serve all of the various trips made to, within, and between different areas of the city.

Houston's transportation system must perform three key functions efficiently: feeder, line haul and circulation and distribution. The private automobile now is beginning to fail in each of these functions, and buses alone simply cannot cope with the resulting requirement.

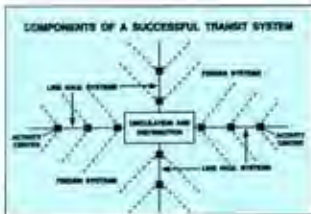
Traffic congestion is growing fastest in the nation's residential suburbs, in the "feeder" function — the access link from home to the closest expressway interchange — is rapidly becoming a time consuming and frustrating experience. Similarly, the through-trip on the arterials and expressways — the "line haul" element — is already congested for most Americans. Finally, it is becoming increasingly difficult for motorists at the circulation and distribution end of the trip to exit the expressway and find a close-in, convenient, low cost parking space within walking distance of their destination.

On the public transportation side, buses, carpools and vanpools could pick up passengers near their homes and transport them to the closest line haul transit station, usually only a few minutes away, but a line haul system doesn't yet exist, and the buses which would otherwise be available are committed to the time-consuming trip to the urban center.

Equally, public transportation also has failed to provide suitable collection and distribution service at the destination end of the trip. Just as motorists are finding it very difficult to locate a suitable parking space within walking distance of their workplace, conventional rail transit stations, especially within the context of the "new urban form" of the 21st-Century American City, are located beyond walking distance from most transit passenger's destinations. A properly designed circulation and distribution system would be ideally suited to distribute proper from the line haul transit station throughout major activity centers, with insignificant wait time.

The backbone of any transit system is the line haul service. Just as the expressway is the backbone of the highway system, line haul public transportation service must be designed to operate at high speeds along business rights-of-way so that the average speed of the line haul system will be higher than automobiles or buses traveling in mixed traffic, even including station stops.

The key to success for public transportation, therefore, is the same as it is for the private automobile: any transportation vision for the future must include new and more effective ways to serve all three components of urban trip-making: feeder, line haul, and circulation.





The Vision for Houston

How Can Public Transportation be Successful in Houston?

It must be designed to match Houston's unique urban form. A truly visionary solution is needed if Houston's major activity centers are to be served in an efficient manner.

Much Has Been Done, but Much More is Needed.

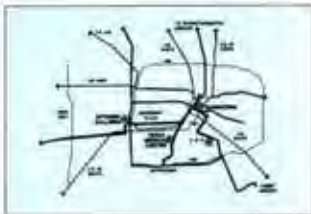
During the last two decades, METRO has greatly improved Houston's local and express bus system, installed rapid-rail buses in the downtown area, and built a series of transitways, which are serving many U.S. cities.

The new public transportation element essential for Houston is the implementation of a line-haul transit system to serve the three major activity centers, to fully integrate with METRO's feeder bus, transitway, and park-and-ride network, working more effectively with carpools and vanpools.

Unique travel patterns result from the unique Houston life style. This can best be characterized as a "many-to-several" pattern rather than the "many-to-one" travel patterns which characterized older U.S. cities which experienced much of their urban growth during the 19th century and the early 20th century. Small Texas towns all demonstrate this many-origins-to-one-destination pattern, where downtown is the place where most commercial and social interaction occurs. But Houston does not — Houston has three major centers and many other smaller ones.

In a very real sense Houston offers at least *three times* the public transportation potential of most cities because it offers the equivalent of three downtown-sized major employment centers: Downtown, Uptown (formerly Galleria/Post Oak), and the Texas Medical Center. The TCI Team believes that it is not possible to cost-effectively serve these three major centers in travel with a conventional rail solution, and that a more innovative and more efficient approach is crucial.

A monorail line-haul transit system could serve all three major centers efficiently and cost-effectively. With the money saved by using monorail for the line-haul system, new circulation and distribution systems could be implemented in several areas of Houston to expand coverage throughout the largest activity centers. Automated people mover systems are ideal for densely developed areas such as the Texas Medical Center and the University of Houston, and may be suitable for Uptown. A circulation system also may make sense for Downtown.





THE MONORAIL SYSTEM

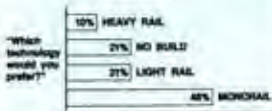
Why Monorail for the Mainline System?

Because it is the least expensive, most attractive, least obtrusive and most appropriate solution. Able to choose from the widest range of transit technologies in the world, TGI selected the M VI monorail for the Mainline or "backbone" of Houston's public transportation system for both the initial Line from the West Belt to Downtown and for the Texas Medical Center/Astrodome Line.

For these higher capacity applications, where the majority of the mainline transit guideway must be squarred from cross-street traffic, primarily in aerial configurations, TGI's M Series Monorail is the least expensive system to build and maintain. Other technologies require a wide, unsightly, trough-type elevated guideway which is supported by huge columns and heavy and difficult-to-site foundations. Simply put, the M VI monorail has the smallest "footprint" on the environment, and is extremely quiet and attractive.

- The M VI monorail causes less construction disruption.
- The M VI monorail is proven and reliable.
- Monorail best fits Houston's progressive 21st Century image.
- Monorail is safe.
- Monorail meets METRO's performance requirements.
- Monorail is extremely quiet — a much better neighbor than noisier technologies.
- All of these factors make monorail a popular choice.

RECENT REFERENDUM IN LARGE SOUTHWESTERN U.S. CITY





Vehicles

Houston's M/V monorail system will be based on the successful new Mark VI monorail fleet now in service at the Walt Disney World Resort in Orlando.



Mark VI Monorail

Three-car trains will require only two-thirds of the proposed station platform lengths for initial operation, with easy expansion to meet the normal capacity of 30,000 passengers per peak hour per direction. An initial fleet of 16 three-car units will be used for the initial line, providing an installed capacity of 5,500 passengers per hour per direction. As ridership increases, additional vehicles will be added to reach an ultimate capacity of 20,000 passengers per hour per direction — roughly equivalent to 8 to 10 freeway lanes in each direction.

Proposed Minimal Vehicle



Capable of cruising at speeds up to 55 miles per hour, the bi-directional monorail trains will travel from the West Belt to downtown in less than 25 minutes. Each three-car unit is 103 feet long and has a capacity of 20 seated and 72 standing passengers in air-conditioned comfort under normal operating conditions, and can accommodate another 35 standees during rush hour. Proven, reliable sliding doors with pressure sensitive rubberized edges provide high capacity access and egress.

Automatic couplers allow for the automatically actuated formation of multiple units, permitting train length to be tailored to the passenger demand throughout the day.

The electric propulsion system will draw clean, pollution-free electric energy from Houston Lighting and Power's local power grid, and the total power demand for the monorail should not require a major addition to the existing generating capacity. The modular, "off-the-shelf" power substations will be located approximately every mile along the guideway, integrated into the station, converting the local public power supply to the 750-volt DC distribution system alongside the guideway.

The propulsion system will utilize state-of-the-art techniques to make the Houston Monorail perhaps the most energy efficient transit system in the United States. In addition to requiring far less energy per

Proposed Proposed Monorail

